

TOSHIBA PHOTOCOUPLER GaAs IRED &amp; PHOTO-TRANSISTOR

# TLP631, TLP632

PROGRAMMABLE CONTROLLERS

AC/DC-INPUT MODULE

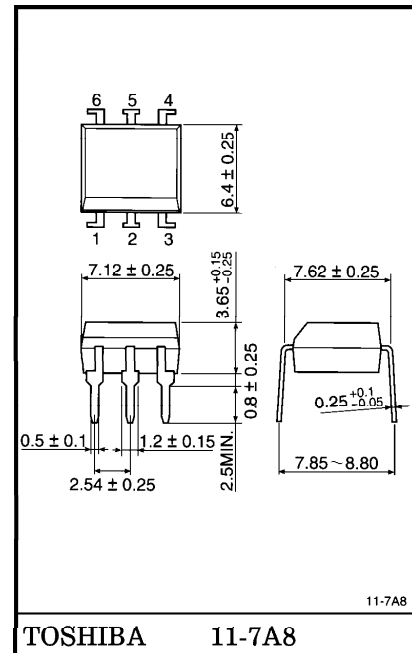
SOLID STATE RELAY

The TOSHIBA TLP631 and TLP632 consist of a photo-transistor optically coupled to a gallium arsenide infrared emitting diode in a six lead plastic DIP.

TLP632 is no-base internal connection for high-EMI environments.

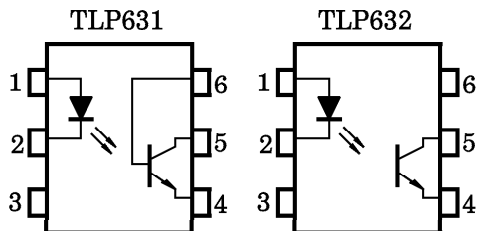
- Collector-Emitter Voltage : 55V (MIN.)
- Current Transfer Ratio : 50% (MIN.)  
Rank GB : 100% (MIN.)
- Isolation Voltage : 5000V<sub>rms</sub> (MIN.)
- UL Recognized : UL1577, File No. E67349

Unit in mm



Weight : 0.4g

## PIN CONFIGURATIONS (TOP VIEW)



- |               |               |
|---------------|---------------|
| 1 : ANODE     | 1 : ANODE     |
| 2 : CATHODE   | 2 : CATHODE   |
| 3 : N.C.      | 3 : N.C.      |
| 4 : EMITTER   | 4 : EMITTER   |
| 5 : COLLECTOR | 5 : COLLECTOR |
| 6 : BASE      | 6 : N.C.      |

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## MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC                                       |                                            | SYMBOL               | RATING  | UNIT             |
|------------------------------------------------------|--------------------------------------------|----------------------|---------|------------------|
| LED                                                  | Forward Current                            | I <sub>F</sub>       | 60      | mA               |
|                                                      | Forward Current Derating (Ta ≥ 39°C)       | ΔI <sub>F</sub> / °C | −0.7    | mA / °C          |
|                                                      | Peak Forward Current (100μs pulse, 100pps) | I <sub>FP</sub>      | 1       | A                |
|                                                      | Reverse Voltage                            | V <sub>R</sub>       | 5       | V                |
|                                                      | Junction Temperature                       | T <sub>j</sub>       | 125     | °C               |
| DETECTOR                                             | Collector-Emitter Voltage                  | V <sub>CEO</sub>     | 55      | V                |
|                                                      | Collector-Base Voltage (TLP631)            | V <sub>CBO</sub>     | 80      | V                |
|                                                      | Emitter-Collector Voltage                  | V <sub>ECO</sub>     | 7       | V                |
|                                                      | Emitter-Base Voltage (TLP631)              | V <sub>EBO</sub>     | 7       | V                |
|                                                      | Collector Current                          | I <sub>C</sub>       | 50      | mA               |
|                                                      | Power Dissipation                          | P <sub>C</sub>       | 150     | mW               |
|                                                      | Power Dissipation Derating (Ta ≥ 25°C)     | ΔP <sub>C</sub> / °C | −1.5    | mW / °C          |
|                                                      | Junction Temperature                       | T <sub>j</sub>       | 125     | °C               |
| Storage Temperature Range                            |                                            | T <sub>stg</sub>     | −55~125 | °C               |
| Operating Temperature Range                          |                                            | T <sub>opr</sub>     | −55~100 | °C               |
| Lead Soldering Temperature (10s)                     |                                            | T <sub>sol</sub>     | 260     | °C               |
| Total Package Power Dissipation                      |                                            | P <sub>T</sub>       | 250     | mW               |
| Total Package Power Dissipation Derating (Ta ≥ 25°C) |                                            | ΔP <sub>T</sub> / °C | −2.5    | mW / °C          |
| Isolation Voltage (AC, 1 min., R.H. ≤ 60%)           |                                            | BV <sub>S</sub>      | 5000    | V <sub>rms</sub> |

## RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC        | SYMBOL           | MIN. | TYP. | MAX. | UNIT |
|-----------------------|------------------|------|------|------|------|
| Supply Voltage        | V <sub>CC</sub>  | —    | 5    | 24   | V    |
| Forward Current       | I <sub>F</sub>   | —    | 16   | 25   | mA   |
| Collector Current     | I <sub>C</sub>   | —    | 1    | 10   | mA   |
| Operating Temperature | T <sub>opr</sub> | −25  | —    | 85   | °C   |

## INDIVIDUAL ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC |                                           | SYMBOL        | TEST CONDITION                                | MIN. | TYP. | MAX. | UNIT          |
|----------------|-------------------------------------------|---------------|-----------------------------------------------|------|------|------|---------------|
| LED            | Forward Voltage                           | $V_F$         | $I_F = 10\text{mA}$                           | 1.0  | 1.15 | 1.3  | V             |
|                | Reverse Current                           | $I_R$         | $V_R = 5\text{V}$                             | —    | —    | 10   | $\mu\text{A}$ |
|                | Capacitance                               | $C_T$         | $V = 0, f = 1\text{MHz}$                      | —    | 30   | —    | pF            |
| DETECTOR       | Collector-Emitter Breakdown Voltage       | $V_{(BR)CEO}$ | $I_C = 0.5\text{mA}$                          | 55   | —    | —    | V             |
|                | Emitter-Collector Breakdown Voltage       | $V_{(BR)ECO}$ | $I_E = 0.1\text{mA}$                          | 7    | —    | —    | V             |
|                | Collector-Base Breakdown Voltage (TLP631) | $V_{(BR)CBO}$ | $I_C = 0.1\text{mA}$                          | 80   | —    | —    | V             |
|                | Emitter-Base Breakdown Voltage (TLP631)   | $V_{(BR)EBO}$ | $I_E = 0.1\text{mA}$                          | 7    | —    | —    | V             |
|                | Collector Dark Current                    | $I_{CEO}$     | $V_{CE} = 24\text{V}$                         | —    | 10   | 100  | nA            |
|                |                                           |               | $V_{CE} = 24\text{V}, T_a = 85^\circ\text{C}$ | —    | 2    | 50   | $\mu\text{A}$ |
|                | Capacitance Collector to Emitter          | $C_{CE}$      | $V = 0, f = 1\text{MHz}$                      | —    | 10   | —    | pF            |

## COUPLED ELECTRICAL CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                       | SYMBOL                  | TEST CONDITION                                      | MIN. | TYP. | MAX. | UNIT |
|--------------------------------------|-------------------------|-----------------------------------------------------|------|------|------|------|
| Current Transfer Ratio               | $I_C / I_F$             | $I_F = 5\text{mA}, V_{CE} = 5\text{V}$<br>Rank GB   | 50   | —    | 600  | %    |
|                                      |                         |                                                     | 100  | —    | 600  |      |
| Saturated CTR                        | $I_C / I_F(\text{sat})$ | $I_F = 1\text{mA}, V_{CE} = 0.4\text{V}$<br>Rank GB | —    | 60   | —    | %    |
|                                      |                         |                                                     | 30   | —    | —    |      |
| Collector-Emitter Saturation Voltage | $V_{CE(\text{sat})}$    | $I_C = 2.4\text{mA}, I_F = 8\text{mA}$              | —    | —    | 0.4  | V    |

ISOLATION CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC                | SYMBOL | TEST CONDITION       | MIN.               | TYP.             | MAX. | UNIT |
|-------------------------------|--------|----------------------|--------------------|------------------|------|------|
| Capacitance (Input to Output) | CS     | VS=0, f=1MHz         | —                  | 0.8              | —    | pF   |
| Isolation Resistance          | RS     | VS=500V, R.H.≤60%    | 5×10 <sup>10</sup> | 10 <sup>14</sup> | —    | Ω    |
| Isolation Voltage             | BVS    | AC, 1 minute         | 5000               | —                | —    | Vrms |
|                               |        | AC, 1 second, in oil | —                  | 10000            | —    |      |
|                               |        | DC, 1 minute, in oil | —                  | 10000            | —    | Vdc  |

SWITCHING CHARACTERISTICS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | TEST CONDITION                                            | MIN. | TYP. | MAX. | UNIT |
|----------------|--------|-----------------------------------------------------------|------|------|------|------|
| Rise Time      | tr     | VCC=10V, IC=2mA<br>RL=100Ω                                | —    | 2    | —    | μs   |
| Fall Time      | tf     |                                                           | —    | 3    | —    |      |
| Turn-on Time   | ton    |                                                           | —    | 3    | —    |      |
| Turn-off Time  | toff   |                                                           | —    | 3    | —    |      |
| Turn-on Time   | tON    | RL=1.9kΩ (Fig.1)<br>RBE=OPEN<br>VCC=5V, IF=16mA           | —    | 2    | —    | μs   |
| Storage Time   | ts     |                                                           | —    | 15   | —    |      |
| Turn-off Time  | tOFF   |                                                           | —    | 25   | —    |      |
| Turn-on Time   | tON    | RL=1.9kΩ (Fig.1)<br>RBE=220kΩ (TLP631)<br>VCC=5V, IF=16mA | —    | 2    | —    | μs   |
| Storage Time   | ts     |                                                           | —    | 12   | —    |      |
| Turn-off Time  | tOFF   |                                                           | —    | 20   | —    |      |

Fig.1 SWITCHING TIME TEST CIRCUIT

